Spotlight on...

Peter Brzezinski

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Peter Brzezinski first became interested in his research area, applying physical techniques to biological systems, after taking a course during his undergraduate degree. His PhD at Göteborg University with the late Bo Malmström was followed by a post-hoc with George Feher at UCSD. He then moved back to Sweden and eventually assumed a professorship at the University of Stockholm. "My main motivation is general curiosity; I want to know how things work. I feel privileged as a scientist to have my hobby as my job and to be paid for what I love to do." Peter edits manuscripts dealing with bioenergetics and the biophysics of proteins, with an emphasis on membrane-bound proteins.

Do people often mispronounce your name?
Yes, my name is Polish, people tend to pronounce my name "Bresinski". I'm used to it. I think I've seen all possible spelling permutations.

Your father is a professor. Did he influence you?
Yes. Because of him, I knew what being a professor was about. He is an academic mathematician, and my mother, by the way, works in art literature, so I was influenced by the academic atmosphere in my home.

What are you working on in your lab?
We study the structure and function of membrane proteins involved in energy conservation. We investigate how these proteins are affected by the membrane surrounding them, and vice versa. For example, we reconstitute proteins in lipid membranes and use biophysical techniques, like laser flashes, to initiate reactions, which we follow in time. We also study the transport of peptides across membranes by measuring the change in potential as the peptides move across a membrane. Finally, we use spectroscopy on protein crystals, trapping reaction intermediates in crystals with the aim of observing the structural changes during an enzyme's catalytic cycle. In particular, one system we focus on is cytochrome *c* oxidase (CcO). This is a membrane-bound proton pump, which couples electron transfer to proton transfer across membranes. In one CcO mutant we work on, these processes are uncoupled, so this mutant gives us insight into how this coupling works [1]. Another project in our lab deals with developing a bacterial biosensor for landmines.

Landmines?
Yes, our goal is to develop a simple and cheap tool that can be used to detect landmines. We use bacteria that are able to digest nitrotoluenes, which are commonly used in explosives. For these bacteria, nitrotoluenes are tasty, a good source of nitrogen and carbon. The explosive-sensor is actually a transcription factor responsible for activating one enzyme in their unique degradation pathway. To make explosive-sensing bacteria, the DNA of this enzyme was replaced with that of green fluorescence protein. While the bacteria think they are making the explosive-degrading enzyme, they actually fluoresce. Last year we determined the structure of this transcription factor [2]. We discovered that when it is bound by explosive material, its structure changes, enabling the transcription process. This structure gave us a whole set of new ideas and directions for this project.

Why do you find science interesting?
Because it is unpredictable. It's the result of new findings. I find it fascinating that I don't know where my research will end up. In particular, I like that it is possible to combine experimental data with theoretical calculations to understand a mechanism. I think that it is really fascinating to combine tools from different disciplines.

Have you ever discovered something completely surprising?
Yes, of course this happens, sometimes! A scientist can often predict the general direction a project will take but the most exciting discoveries happen when we can't understand the results of an experiment, or even a set of experiments. Only on further insight and hindsight do we arrive at an idea of how these experiments fit in with a larger, mechanistic scenario.

Can you give an example?
For instance we were studying the proton pumping mechanism by CcO. It was believed that the proton coupling and the electron movements were strictly coupled in time. This assumption places a very strong limitation on possible mechanisms. However, when we started to look in detail at how these processes occur with time, we observed that protons emerged from the membrane when there were no electron movements. This is a fundamental observation that changes how we think about this mechanism [3].

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Interview by Tine Walma

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